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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/709,616	11/13/2000	David W. Warren	12.150	4083

7590

06/02/2003

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EXAMINER

LEUNG, JENNIFER A

ART UNIT

PAPER NUMBER

1764

DATE MAILED: 06/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/709,616

Applicant(s)

WARREN ET AL.

Examiner

Jennifer A. Leung

Art Unit

1764

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-14 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Drawings and Specification

1. The drawings and specification have not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware.
2. The disclosure is objected to because of the following informalities:
 - On page 10, line 9, "stem" should be changed to -- steam --.
 - On page 10, line 17, "cooled steam 18" should be changed to -- cooled stream 18 --.

Appropriate correction is required.

Claim Objections

3. Claims 1, 2, 7, 11 and 12 are objected to because of the following informalities:
 - In claim 1, -- recovery -- should be inserted before "steam" (line 11) and -- waste-heat recovery -- should be inserted before "steam" (line 15), for consistency in claim terminology.
 - In claim 2, -- recovery -- should be inserted before steam (line 2), for consistency in claim terminology. Also, the second recitation of the term "of" in line 3 should be omitted for proper grammatical form.
 - In claim 7, -- an -- (or -- the--) should be inserted before "annular space" (line 3) for proper grammatical form.
 - In claim 11, "stem" (line 2) should be changed to -- steam --. Also, -- recovery -- should be inserted after "heat" (line 2) for consistency in claim terminology.
 - In claim 12, "said upper and lower levels" (lines 6-7) should be changed to -- said upper

Art Unit: 1764

and lower level outlets -- for consistency in claim terminology. Also, -- waste-heat recovery -- should be inserted before "steam" (line 2) for consistency in claim terminology.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

With respect to claim 1, "the beneficial recovery" (line 6) is considered vague and indefinite, since it is unclear as to what applicants consider beneficial. Also, "low temperature" (lines 1-2, 17) is considered vague and indefinite, since "low" is a relative term. Also, it is unclear as to the relationship between, "a process for the conversion of hydrocarbon feedstock into hydrogen-rich gases" (lines 7-9) and "a low temperature shift reaction" (line 17), to the conversion of "carbon monoxide in the presence of steam to form carbon dioxide and water" set forth in the preamble. Also, "reformat gases" (line 13) lacks proper positive antecedent basis

With respect to claim 2, "the low temperature water-gas shift reaction" lacks proper positive antecedent basis and is considered vague and indefinite, since "low" is a relative term.

With respect to claim 3, it is unclear as to the relationship of "a Cu/Zn catalyst" to the "catalyst bed" set forth in claim 1. Also, it is unclear as to which structural element the

Art Unit: 1764

limitation of, "having an inner wall that is in thermal contact..." (lines 3-5) is directed.

With respect to claims 4-5, it is unclear as to the structural limitation applicants are attempting to recite by, "is located to transfer heat". Also, the phrase "normal operation" (claim 5, line 3) is considered vague and indefinite, as it is unclear as to what is considered normal.

With respect to claim 6, "the annulus" (line 3) lacks proper positive antecedent basis.

With respect to claim 7, "the inner and outer walls" (line 2), "said annulus" (line 3), and "the process gases" (line 4) lack proper positive antecedent basis.

With respect to claim 8, it is unclear as to the structural limitation applicants are attempting to recite by, "the catalyst bed is maintained in one of the following ranges..." (lines 1-4), since the recited temperature range is a process limitation.

With respect to claim 9, "typically" (line 2) is considered vague and indefinite, since it is unclear as to what applicants consider to be typical. Furthermore, "the outside and inside walls" (lines 3-4) lacks proper positive antecedent basis.

With respect to claim 10, the language of the claim is drawn to a method limitation which renders the claim vague and indefinite, since it is unclear as to the structural limitation applicants are attempting to recite, since "the gas" is not considered an element of the apparatus.

With respect to claim 11, "hot combustion products" (lines 8-9) lacks proper positive antecedent basis, and is further considered vague and indefinite, since "hot" is a relative term.

With respect to claim 12, it is unclear as to the relationship of "a catalyst bed" (line 18) to "a catalyst bed" set forth in line 16 as well as claim 1 (line 12). Also, "hot products" (line 10) is considered vague and indefinite, since "hot" is a relative term. Also, it is unclear as to the relationship of "a combustion process" (line 11) to the other elements of the apparatus.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-5, 7, 8 and 10-14 are rejected under 35 U.S.C. 102(b) as being anticipated by Collins et al. (U.S. 5,458,857).

With respect to claim 1, Collins et al. (FIG. 3, 4, 6, 7; column 8, line 19 to column 12, line 52; more specifically, column 8, lines 35-53; column 9, lines 35-54) disclose a thermally-integrated low temperature water-gas shift reactor comprising, in combination,

– a waste-heat recovery steam generator **416** for the recovery of exothermic reaction heat to generate steam that is used in a process for the conversion of hydrocarbon feedstock into hydrogen-rich gases (i.e. by supplying steam via pipe **472** to reforming chamber **422** for conducting a reforming process); and

– an outer region (i.e. comprising low temperature shift reactor **414**) extending about said waste-heat steam generator **416**; wherein a catalyst bed (i.e. a suitable low temperature shift reaction catalyst **438**) is located within said outer region, and through which reformat gases flow (i.e. reformat flow from upper chamber **462** to lower chamber **464**); the outer region **414** being in heat transfer communication with the steam generator **416** to maintain the catalyst bed **438** within a predetermined temperature range for operation of a low temperature shift reaction.

With respect to claim 2, no further structural limitations are recited, since the operating temperature of the generator **416** is not considered an element of the apparatus, and therefore the

Art Unit: 1764

apparatus of Collins et al. meets the claim. In any event, Collins et al. further disclose, "The temperature of the steam generator **416** and therefore the temperature of the low temperature shift reaction catalyst **438** is controlled by regulating the temperature of the steam generator **416**," and the catalyst **438** is ideally operated at a temperature between 140 °C and 220 °C, which is equivalent to 284 °F and 428 °F, and possibly a broader range such as 110 °C to 250 °C, which is equivalent to 230 °F to 482 °F (column 11, lines 7-19; column 12, lines 40-46).

With respect to claims 3-5, Collins et al. (FIG. 3, 4, 6, 7) further disclose the suitable low temperature shift catalyst **438** may comprise, for example, a Cu/Zn catalyst, the apparatus having an inner wall (i.e. as defined by tube **436**) that is in thermal contact with said generator **416**, such that the boiling water fluid (i.e. in water space **432**, steam space **434**) is located to transfer heat to the catalyst bed to heat the bed during start-up, and the catalyst bed is located to transfer heat to the boiling water fluid during normal operation to generate steam (column 8, lines 45-51; column 10, line 68 to column 11, line 46).

With respect to claim 7, Collins et al. further disclose a helical coil (i.e. pipes **468**, **470** arranged in helical coils; column 9, lines 35-54; FIG. 3, 7) adjacent the inner and outer walls to conduct and inherently increase the velocity of the process gases.

With respect to claim 8, no further structural limitations are recited, since the operating temperature of the catalyst bed **438** is not considered an element of the apparatus, and therefore the apparatus of Collins et al. meets the claim. In any event, Collins et al. further disclose the catalyst **438** is ideally operated at a temperature between 140 °C and 220 °C, equivalent to 284 °F and 428 °F, and possibly a broader range such as 110 °C to 250 °C, equivalent to 230 °F to 482 °F (column 11, lines 7-19; column 12, lines 40-46).

Art Unit: 1764

With respect to claim 10, no further structural limitations are recited, since the range of gas hourly space velocity is not considered an element of the apparatus, and therefore the apparatus of Collins et al. meets the claim.

With respect to claim 11, Collins et al. (FIG. 3, 4, 6, 7; column 8, lines 54-68; column 11, lines 29-46) disclose the waste steam generator **416** comprises one or more heat transfer conduits (i.e. start-up tubes **417**) that transfer heat from hot combustion products to a boiling water fluid (i.e. contained in water space **432**, steam space **434**) for the purpose of generating steam.

With respect to claim 12, Collins et al. (FIG. 3, 4, 6, 7; column 8, lines 36-68; column 9, lines 21-35) disclose generator **416** includes an upright vessel, said outer region **414** having an upper level inlet (i.e. via upper chamber **422**), and said region **414** having a lower level outlet (i.e. via lower chamber **464**), a catalyst bed **438** located between said upper and lower levels, a heat transfer conduit or conduits (i.e. start-up tubes **417**) extending within said vessel and immersed within boiling water contained in said vessel (i.e. located within water space **432**, steam space **434**) inwardly of said catalyst bed **438**, said conduit or conduits **417** receiving hot products of combustion from a combustion process (i.e. via combustion catalyst **429**), for transfer of heat to the boiling water, for generating steam exiting from said vessel.

With respect to claim 13, Collins et al. disclose the catalyst bed **438** extends helically about said generator **416** (FIG. 3; column 8, lines 36-53).

With respect to claim 14, Collins et al. further disclose a helical coil (i.e. pipes **468**, **470**, arranged in helical coils; column 9, lines 35-54; FIG. 3, 7) in said outer region and extending about said generator **416**.

Instant claims 1-5, 7, 8 and 10-14 structurally read on the apparatus of Collins et al.

Art Unit: 1764

6. Claims 1-5, 7, 8, 10 and 13 are rejected under 35 U.S.C. 102(b) as being anticipated by Sederquist et al. (WO 97/44123).

With respect to claim 1, Sederquist et al. (FIG. 1; page 5, "Best Mode..." to page 6, second paragraph) disclose a thermally-integrated low temperature water-gas shift comprising, in combination,

- a waste-heat recovery steam generator (i.e. comprising heat exchange device **38**, for passing a pressurized water coolant) for the recovery of exothermic reaction heat; and
- an outer region (i.e. comprising cylindrical catalyst chamber **12**) extending about said generator **38**; wherein a catalyst bed **30** is located, and through which reformat gases flow (i.e. entering via upstream plenum **53** to exiting via downstream plenum **54**); and wherein the outer region **12** is in heat transfer communication with the steam generator **38** to maintain the catalyst bed **30** within a predetermined temperature range.

With respect to claim 2, no further structural limitations are recited, since the operating temperature of the generator is not considered an element of the apparatus, and therefore the apparatus of Sederquist et al. meets the claim. In any event, Sederquist et al. further disclose operation of the steam generator within the recited ranges (page 7, second and third paragraphs).

With respect to claim 3, Sederquist et al. further disclose the catalyst bed **30** may comprise a Cu/Zn catalyst (page 5, last paragraph), and having an inner wall (i.e. as defined by the tube wall of cooling coils **40**; FIG. 1) in thermal contact with a boiling water fluid in said generator **38** (page 4, last paragraph).

With respect to claims 4-5, Sederquist et al. disclose the boiling water fluid (within generator **38**) is located to transfer heat to the catalyst bed **30** to heat the bed, and the catalyst bed

Art Unit: 1764

is located to transfer heat to the boiling water fluid to generate steam (page 4, last paragraph; page 7, second and third paragraph).

With respect to claim 7, Sederquist et al. disclose a helical coil (i.e. plurality of cooling coils **40**; FIG. 1) adjacent the inner and outer walls to conduct and inherently increase the velocity of the process gases as they flow through the catalyst bed **30** and to enhance the rate of heat transfer to and from the catalyst bed.

With respect to claim 8, no further structural limitations are recited, since the operating temperature of the catalyst bed is not considered an element of the apparatus, and therefore the apparatus of Sederquist et al. meets the claim. In any event, Sederquist et al. disclose the catalyst bed is maintained within the recited temperature ranges (page 7, second and third paragraphs).

With respect to claim 10, no further structural limitations are recited, since the range of gas hourly space velocity is not considered an element of the apparatus, and therefore the apparatus of Sederquist et al. meets the claim.

With respect to claim 13, Sederquist et al. disclose the catalyst bed **30** extends helically about said generator (see FIG. 1).

Instant claims 1-5, 7, 8, 10 and 13 structurally read on the apparatus of Sederquist et al.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Art Unit: 1764

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al. (U.S. 5,458,857) in view of Houdry (U.S. 2,078,948).

Collins et al. disclose, "it is also possible to use other suitable heat exchanger arrangements to transfer heat between the low temperature shift reactors and the steam generator," (column 12, lines 31-39) and suggests "plate fin heat exchanger etc." However, Collins et al. are silent as to specifically, longitudinal heat transfer fins attached to an inside wall of the annulus and projecting in said bed. In any event, it would have been an obvious design choice for one of ordinary skill in the art at the time the invention was made to provide heat transfer fins to the wall in the apparatus of Collins et al., on the basis of suitability for the intended use and absent showing any unexpected results thereof, since the use of heat transfer fins for enhancing heat transfer is conventionally known in the art, as evidenced by Houdry. In particular, Houdry teaches the use of heat transfer fins for the removal of excess heat of reaction in a uniform manner so as to maintain the entire contact mass within a predetermined temperature range (FIG. 1-5; column 1, lines 14-24; column 3, lines 3-48).

Art Unit: 1764

8. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Collins et al. (U.S. 5,458,857).

Although Collins et al. are silent as to whether the annular space may be between 1 and 2 inches wide, to minimize the temperature differentials between the outside and inside walls defined by the annular space, it would have been an obvious design choice for one of ordinary skill in the art at the time the invention was made to select an appropriate width for the annular space in the apparatus of Collins et al., on the basis of suitability for the intended use and absent showing any unexpected results thereof, since it has been held that changes in size involve only ordinary skill in the art. *In re Rose*, 220 F.2d 459, 463, 105 USPQ 237, 240 (CCPA 1955), and where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art, *In re Aller*, 105 USPQ 233.

9. Claims 1, 2, 7, 8 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Buswell et al. (U.S. 5,464,606).

With respect to claim 1, Buswell et al. (FIG. 3, 4; column 4, line 12 to column 5, line 12) disclose a low temperature water-gas shift reactor comprising, in combination,

- a waste-heat recovery heat exchanger (i.e. within cooled section **304/404**, comprising coolant coil **306/406**, for the beneficial recovery of exothermic reaction heat;
- an outer region extending about the heat exchanger **306/406** wherein a catalyst bed is located (i.e. annular catalyst bed **302/402**), and through which reformat gases flow; and wherein the outer region is in heat transfer communication with the heat exchanger **306/406** to maintain the catalyst bed **302/402** within a predetermined temperature range.

Although Buswell et al. is silent as to whether the heat exchange medium or coolant fluid for the

Art Unit: 1764

heat exchanger **306/406** may comprise specifically water, such that steam is generated by the heat exchanger, the apparatus of Buswell et al. meets the claims, since the apparatus comprises substantially the structural elements as recited and is therefore capable of generating steam. Furthermore, it would have been an obvious design choice for one of ordinary skill in the art at the time the invention was made to select water as a heat exchange medium in the apparatus of Buswell et al., on the basis of suitability for the intended use and absent showing any unexpected results thereof, since the use as water/steam as a heat exchange medium is well known in the art.

With respect to claim 2, no further structural limitations are recited since the operating temperature range of heat exchanger **306/406** is not considered a structural element of the apparatus, and therefore the apparatus of Buswell et al. meets the claim.

With respect to claim 7, Buswell et al. (FIG. 3, 4; column 4, line 12 to column 5, line 12) disclose a helical coil **306/406** adjacent the inner and outer walls to conduct and inherently increase the velocity of the process gases as they flow through the catalyst bed **302/402** and to enhance the rate of heat transfer to and from the catalyst bed.

With respect to claim 8, no further structural limitations are recited since the operating temperature range of the catalyst bed **302/402** is not considered a structural element of the apparatus, and therefore the apparatus of Buswell et al. meets the claim. In any event, Buswell et al. disclose a catalyst bed operating temperature within the recited temperature ranges (see column 4, lines 13-27; 47-56).

With respect to claim 13, Buswell et al. disclose the catalyst bed **302/402** extends helically about said generator **306/406** (see FIG. 3, 4).

Instant claims 1, 2, 7, 8 and 13 structurally read on the apparatus of Buswell et al.

Art Unit: 1764

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: Muenger is provided to illustrate the state of the art.

* * *

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer A. Leung whose telephone number is 703-305-4951.

The examiner can normally be reached on 8:30 am - 5:30 pm M-F, every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn A. Caldarola can be reached on 703-308-6824. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Jennifer A. Leung
May 27, 2003 JAL

Hien Tran

**HIEN TRAN
PRIMARY EXAMINER**